SVT Hardware Outlook

D. Lynn, May 27, 2004

1. SVT Live/useful channels

2. Time required for SVT Repair or Inner Layer Removal for APS-MVD installation

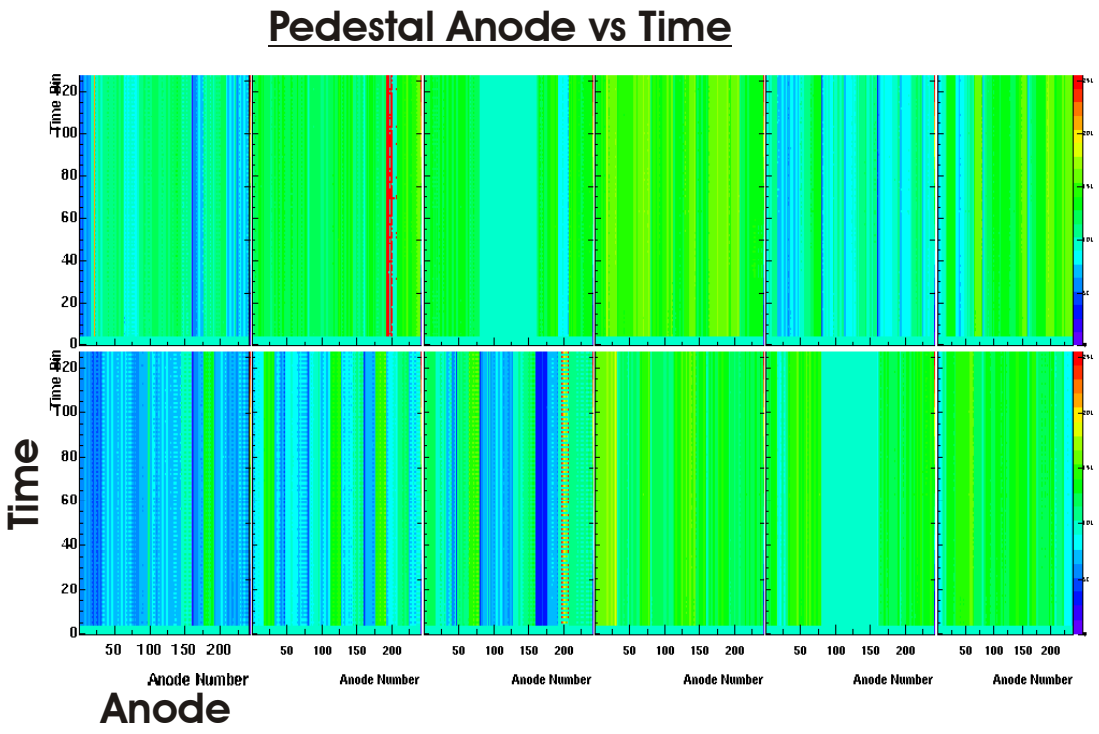
3. Maintenance

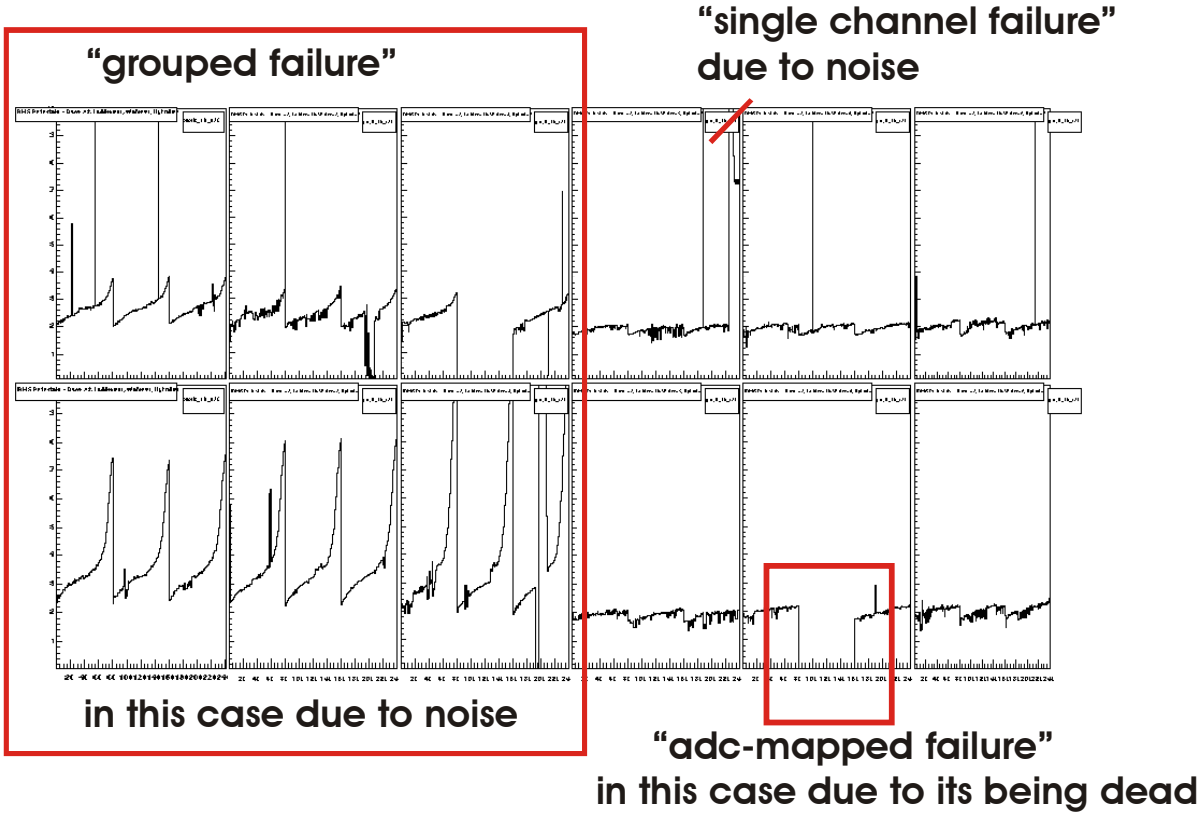
4. Spares, Maintenance Budget, Manpower

5. SVT Readout Speed

Example of "Bad" Channels

- "Bad" means noisy or dead
- failures can be grouped (½ ladder, ¼ ladder), adc-mapped, or individual





SVT History of Percentage of "Bad Channels"*

* "Bad" = dead or noisy.

1. **36 ladders built**	Ended ~ January 2001	**< 1%**
2. Ladders mounted on end-rings and installed on cone	Ended ~ March 2001	
3. RunII AuAu	Aug 2001-Nov 2001	
4. **RunII-pp**	Dec 2002-Jan-2002	**~3.7%**
5. Shutdown 2002 (leak repair)	Feb 2002-Sept 2002	
6. **RunIII Commissioning**	Oct 2002-Dec 2002	**~10.5%**
7. **RunIII(dAu and pp)**	Jan 2003- May 2003	**~12.7%**
8. **Beginning of RunIV**	Jan 2004	**~13.6%**
9. **Last day data taking RunIV**	May 2004	**~15.9%**

Comments:

- Percentage of bad channels shown do not indicate percentage that was active for the various runs but rather the percentage that is intrinsically damaged. e.g. during some runs failed Readout Boxes (which can be repaired) resulted in a lower operational active detector.

- Last shutdown was first time SVT was "mostly" left alone (cone was pulled out for SSD installation). **Number of bad channels remained fairly stable!**

- Hopefully this trend will continue

p.s. Tests conducted two days ago seemed to get ~1.5 % back by jiggling connectors
Another 1.5% came back (1/2 ladder that comes and goes)

Failures con't

- Most of the failures are either "grouped" or adc-mapped
- Some "grouped failures" later work.
- ADC-mapped failures may be due to:
  - one sca out of 5 fails
  - one analog driver
  - bad/broken connection from detector to rdo (cable, connector)
  - bad adc in rdo
- There seems to be some increase of both grouped and adc-mapped failures with time
- Not much of a trend toward individual channel failures.
- Note each year SVT has been disconnected from RDOs. Last year involved minimal handling(and perhaps explains minimal changes in percentage)

Long term outlook---Difficult to say.

From end of Run III to end of RunIV we added *as much* as 3% bad channels.

If we choose
to extrapolate with this in 5 years we will be 70% alive.

Issue: How Long to Repair SVT or Remove Inner Layer for APS-MVD Installation

- Previous Experience was during Shutdown Summer 2002
- Needed to replace leaky water fittings on all ladders.
- **Total time was about 5 months**
- People who worked on it were Soja, Lynn, Suire, Chaloupka

- Tasks were
  - Remove Cone
  - Remove SVT
  - Bring to Lab
  - Disconnect Water Manifolds
  - **Saw off water fittings and replace** (necessary if water manifold is disconnected)
  - Reconnect water manifolds
  - Electrically retest in lab
  - Reinstall on Platform
  - Recable (time-consuming: see http://www4.rcf.bnl.gov/~petrchal/)
  - Retest on platform
  - Reinstall in IFC
  - Retest
  - Survey

To remove inner SVT layer for APS-MVD installation

Additional steps are:

- Remove SSD
- Remove inner SVT layer in Lab

  --Probably does not mean removing water manifolds

  --Therefore do not have to remove water fittings--therefore do not have to disassemble all ladders from endrings (i.e. only inner layer ladders need to be removed)

- **Result**: Can probably be done in similar 5 month period.

  →Of course a more detailed plan needs to be written to reliably estimate timescale.

To Repair SVT

(note: see my MIT upgrades talk, Nov 2003, where it is suggested that repairing the SVT is unlikely to be a good idea)

Additional steps are:

- Remove SSD
- Remove Water Manifolds
- Remove all water fittings and replace with redesigned fittings
- Complete disassembly of SVT ladders from endrings
- Repair/Rework/Test each ladder

- **Result**: Can probably assume that this would take an additional 6 months

Maintenance---typical items

- **RDO failures** (can only repair during shutdown. Had 1 failure RunIV, 4 failures in RunIII.)
- Replace failed HV modules
- Water system (replace water pump, motor, vacuum pump, sensors, etc.)
- Fix LV power supplies
- Multimeter failures (monitors numerous temperature and pressure sensors)
- Laser tends to weaken with time. Replace.

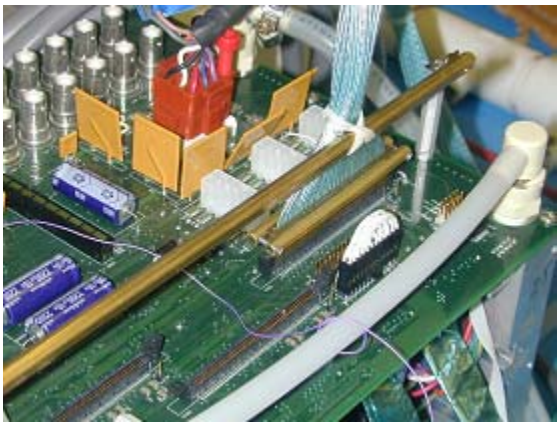
Conclusion: Maintenance effort not very difficult

Note: Only RDO failures cannot be fixed during run
(unless poletips are removed and we have a few days to repair boxes)

Shutdown 2004 Activities

- There are much less hardware changes required than in the past.
- Need to repair 1 RDO and remove 3 others for reprogramming
- This year the main hardware work change be the installation of 72 strain relief clamps on signal cables from SVT to RDOs.

These cables cannot be replaced or fixed and are starting to come apart at the connector.



Spares--Have spares of all critical items that could cause major downtime during running except

- HV Crate (~$15k). Should buy?

Spare slow controls computer not yet ready, but:

- Have spare Sun slow controls computer as backup, but duplicate epics installation not tested and verified.
- R. Witt to implement a backup Linux solution summer 2004

Maintenance Budget

- Expenditures for Maintenance/spares has been typically ~$5k/year
  (may need more for HV crate)

Manpower

- Maintenance—Lynn and some help from operations group
- Run time—Lynn and Witt
- Epics programming---Don't expect to need major changes. Suire (formally SVT, now in France working on Phoenix) will make some major changes if necessary (make take some time). Lynn can make minor changes (i.e. change alarm values). ….

  Could maybe require help to write program to power SVT from single HV crate.
- **Conclusion**. Sufficient manpower for normal operations. Insufficient if want to remove SVT for repair or inner ladder removal.

SVT Readout Speed

1. **SCAs designed for max 200 Hz event rate (somewhat less with overhead).**

   - Limit based upon time it takes for SCAs amplifiers to reach 98% full value
   - Maybe could go somewhat faster with some loss of performance (signal spilling into adjacent channels, some signal loss, maybe increased noise). Would require testing to determine limits. New test station development required.
   - I suspect over 300 Hz unlikely

2. **But…**

   - Current RDO programming limits speed to 120 Hz.
   - Could maybe be increased to ~140-150 Hz with optimized FPGA code
   - To approach 200 Hz and beyond would need RDO redesign (hardware limited)

3. **But then again…**

   - Actual event rate last run was ~80 Hz. The limit was Daq's ability to handle SVT data volume ~1-2%
     (actually, data volume of worst RDO determines readout speed).
   - Perhaps could be improved with elimination of more noisy channels
   - Perhaps could be improved with tighter ASIC cuts (to be studied this summer)